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BUREAU OF PLANT INDUSTRY—Circular No. 122.

WILLIAM A. TAYLOR, Chief of Bureau.

MISCELLANEOUS PAPERS.

Directions for Blueberry Culture . . . . . FREDERICK V. COVILLE

The Work of the Truckee-Carson Experiment Farm in 1912 . . F. B. HEADLEY

Feterita, a New Variety of Sorghum . . . . . H. N. VINALL and CARLETON R. BALL

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[Cir. 122]
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[Cir. 122—A.]

DIRECTIONS FOR BLUEBERRY CULTURE.[1]

By Frederick V. Coville, *Botanist in Charge of Taxonomic and Range Investigations.*

SPECIAL REQUIREMENTS.

Success in blueberry culture rests especially on the recognition of two peculiarities in the nutrition of these plants: First, their requirement of an acid soil; secondly, their possession of a root fungus that appears to have the beneficial function of supplying them with nitrogen.[2]

If blueberries are planted in a soil with an alkaline or neutral reaction, such as the ordinary rich garden or fertile field, it is useless to expect their successful growth. In such a situation they become feeble and finally die. Blueberries require an acid soil, and they thrive best in that particular type of acid soil which consists of a mixture of pure sand and peat. The peat may be of either the bog or the upland sort.

Good aeration of the soil is another essential. It is commonly but erroneously supposed that the swamp blueberry (*Vaccinium corymbosum*), the species chiefly desirable for cultivation, grows best in a permanently wet soil. It is to be observed, however, that the wild plants of the swamps occupy situations which, though perhaps submerged in winter and spring, are exposed during the root-forming period of summer and autumn or, when growing in permanently submerged places, they build up a hummock or a cushion of moss which rises above the summer water level and within which the feeding roots of the bush are closely interlaced. In actual culture, moreover, it has been found that the swamp blueberry does not thrive in a permanently wet or soggy soil.

Although some species of Vaccinium, such as the common low-bush blueberry (*V. pennsylvanicum*), grow and fruit abundantly in sandy uplands that are subject to drought, the swamp blueberry grows best in soils naturally or artificially supplied with adequate moisture.

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[1] Issued Apr. 19, 1913.

[2] For a full discussion of the principles of blueberry culture, including the soil requirements and peculiarities of nutrition of the blueberry plant and the details of the growing of seedlings, consult Experiments in Blueberry Culture, Bulletin 193, Bureau of Plant Industry, 1911.

These, then, are the three fundamental requirements of successful blueberry culture: (1) An acid soil, especially one composed of peat and sand, (2) good drainage and thorough aeration of the surface soil, and (3) permanent but moderate soil moisture. Under such conditions the beneficial root fungus which is believed to be essential to the nutrition of the plant need give the cultivator no concern, for it will propagate itself spontaneously and adequately without any necessity of soil or plant inoculation.

VALUE OF SUPERIOR STOCKS.

Blueberry plantations may be formed by the transplating of unselected wild bushes or by the growing of seedlings, but such a course is not the best. Seedling plants, even from the largest berried parents, produce small berries oftener than large ones. Until nurserymen are prepared to furnish plants asexually propagated from superior stocks, the cultivator should begin by the transplanting of the best wild bushes, selected when in fruit for the size, color, flavor, and earliness of the berry, and the vigor and productiveness of the bush. These he should propagate by layering and by cuttings until his plantation is completed. Through a combination of these two methods, a valuable old plant can be multiplied by several hundred at one propagation, the fruit of the progeny retaining all the characteristics of the parent.

Large berries cost less to pick than small ones and bring a higher price. A berry eleven-sixteenths of an inch in diameter has already been produced under cultivation and others of still larger size are to be expected.

PROPAGATION.

While grafting and especially budding are useful in experimental work, neither method is suitable for commercial plantations because blueberry bushes are continually sending up new and undesirable shoots from the stock. For experimental purposes the best season for budding is from the middle of July to the end of August. The budded plants should be protected from direct sunlight, and special care should be taken that the raffia wrapping does not become wet for the first three weeks.

STUMPING.

The easiest way to propagate the swamp blueberry is by a special process of layering named "stumping." The directions are as follows:

1. In late fall, winter, or spring, preferably in early spring before the buds have begun to push, cut off at the surface of the ground either the whole of

the plant or as many of the stems as it is desired to devote to this method of propagation. The stems that are cut off are discarded, or they may be used for cuttings, as described under "Tubering."

2. Cover the stumps to the depth of 2 to 3 inches with a mixture of clean sand and sifted peat, about 4 parts of sand to 1 of peat, by bulk. A rough box or frame may be built on the ground to keep the sand bed in place.

3. Care must be taken that the sand bed be not allowed to become dry, except at the surface, during the summer.

4. The new growth from the stumps, which without the sand would consist of stems merely, is transformed in working its way through the sand bed into scaly, erect or nearly erect rootstocks which, on reaching the surface of the sand, continue their development into leafy shoots. Although roots are formed only sparingly on the covered bases of stems, they develop abundantly during spring and early summer on these artificially produced rootstocks, and by the end of autumn all the shoots should be well rooted at the base. They should remain in place in the sand bed till late winter or early spring, undisturbed and exposed to outdoor freezing temperatures, but the sand mulched with leaves, preferably those of red oaks.

5. Early in the following spring, before the buds have begun to push, open the bed and sever each rooted shoot carefully from the stump. Discard the upper portion of the shoot, making the cut at such a point as to leave on the basal portion about three buds above the former level of the sand bed. If the cut at the basal end of the rooted shoot is not smooth or the wood is cracked, recut the surface with a sharp thin-bladed knife. The discarded upper portion of the shoot may be used for cuttings, as described under "Tubering."

6. Set the rooted shoots in a cold frame or a cool greenhouse in clean earthenware pots of suitable size, ordinarily 3-inch pots, in a soil mixture consisting of 2 parts of rotted upland peat, by bulk, to 1 part of sand and 1 part of clean broken crocks.

7. Cover the frame with a painted sash or with thin muslin, giving the plants plenty of light but no direct sunlight, and for the first two or three months keep the temperature at not to exceed 65° F. if practicable. When subjected to high temperatures the newly cut shoots are liable to die and rot from the base upward. The outer surface of the pots should never be allowed to become dry. The desired condition may be assured by bedding the pots in moist sand up to the rim.

8. Watering should be as infrequent as practicable, only sufficient to keep the soil moist but well aerated.

9. The frame should receive ventilation, but not enough to cause the new twigs to droop. These are most susceptible to overventilation and to overheating when they have nearly completed their growth.

10. After the new twigs have stopped growing and their wood becomes hard, new root growth takes place. Then secondary twig growth follows, either from the apex of the new twigs or from another bud lower down on the old wood of the original rooted shoot. Until this secondary twig growth takes place the life of the plant is not assured.

11. Those plants that make sufficient growth to require repotting during the first summer should be set in clean pots of 2 inches larger diameter in a standard blueberry soil mixture.

SOIL MIXTURE FOR BLUEBERRIES.

A very successful potting mixture, or nursery-bed mixture, for blueberry plants consists of one part of clean or washed sand, nine parts

of rotted upland peat, either chopped or rubbed through a sieve, and three parts of clean broken crocks. No loam, and especially no lime, should be used. Manure is not necessary, and in the present state of our knowledge may be regarded as dangerous, although in small amounts it serves to stimulate the plants, at least temporarily. The danger from manure apparently lies in its tendency to produce an alkaline condition in the soil.

The use of broken crocks in the potting mixture is based on the fact that the rootlets seek them and form around them the same kind of mats that they form at the wall of the pot, thus increasing the effective root surface and the vigor of growth.

The peat most successfully used for potting blueberry plants is an upland peat procured in kalmia, or laurel, thickets. In a sandy soil in which the leaves of these bushes and of the oak trees with which they usually grow have accumulated and rotted for many years untouched by fire, a mass of rich leaf peat is formed, interlaced by the superficial rootlets of the oak and laurel into tough mats or turfs, commonly 2 to 4 inches in thickness. These turfs, ripped from the soil and rotted from two to six months in a moist but well-aerated stack, make an ideal blueberry peat. A good substitute is found in similar turfs formed in sandy oak woods having an underbrush of ericaceous plants other than laurel. Oak leaves raked, stacked, and rotted for about 18 months without lime or manure are also good. The leaves of some trees, such as maples, rot so rapidly that within a year they may have passed from the acid condition necessary for the formation of good peat to the alkaline stage of decomposition, which is fatal to blueberry plants. Even oak leaves rotted for several years become alkaline if they are protected from the addition of new leaves bearing fresh charges of acidity.

TUBERING.

By ordinary methods, cuttings of the swamp blueberry have been rooted only in occasional instances. Two successful methods, however, have been especially devised for these plants. The most novel of these but the one easiest of operation is that of "tubering." This method involves the same principle as that employed in stumping, namely, the forcing of new shoots in such a manner that their basal portions are morphologically scaly rootstocks, with a strong rooting tendency. The directions for tubering as applied to the swamp blueberry are as follows:

1. Make stem cuttings from outdoor plants between midwinter and early spring, before the buds have begun to make their spring growth, and preferably on a warm day when the twigs are not frozen. A still better plan is to make the cuttings in autumn after the leaves have fallen, and store them for

about two months in moist sphagnum on ice at a temperature just above freezing.

2. The cuttings are to be made from vigorous plants grown in well-lighted situations and with stems therefore well stored with starch. Use unbranched portions of the old and hardened branches and stems, about a quarter of an inch to an inch or even more in diameter. Three to four inches is a suitable and convenient length. Make the cuts with pruning shears or a fine-toothed saw and remove the bruised wood at the cut ends with a sharp knife. Be careful not to injure the bark or split or strain the wood.

3. Lay the cuttings horizontally in a shallow box or other cutting bed of pure clean sand and cover them to the depth of about half an inch. Moisten the sand well with rain water, bog water, or other pure water (free from lime) from a sprinkling pot, and see that the sand is closely and firmly packed about the cuttings. Cover the box or cutting bed with a pane or panes of glass, the top of the box being flat, so that the glass fits it rather tightly. The box should be so prepared that any surplus water in the sand will drain away beneath through holes in the bottom covered with clean broken crocks and sphagnum moss.

4. Keep the box at a temperature of 55° to 65° F., or as near those limits as practicable. A temperature of 70° or over is likely to ruin the cuttings.

5. In order to avoid excessive temperatures, do not allow direct sunlight upon the glass, either keeping the box by north light or keeping it shaded, as by a white cloth or paper cover suspended several inches above the glass or in a shaded greenhouse.

6. Keep the air inside the box saturated with moisture. This condition will be evidenced by the condensation of the moisture on the under side of the glass during the cooler part of the day or whenever a cold wind blows against the glass.

7. Watering should be as infrequent as practicable, only sufficient to keep the sand moist but well aerated and the atmosphere in the box saturated. If the glass fits tightly, a second watering may not be needed for several weeks, when ventilation of the growing shoots has reduced the moisture of the cutting bed.

8. Within a few weeks new growth will begin to appear above the sand. Ventilation may then be given by sliding the glass until a crack is left open at one side of the box, but the air beneath the glass should still remain in a condition of approximate saturation. If the new growth starts to wilt, reduce the ventilation till the wilting ceases.

9. When the shoots have reached a length proportionate to their vigor, commonly 1 to 3 inches, their further growth is self-terminated by the death of the tip. After the leaves have reached their full size and acquired the dark-green color of maturity the time has come for the development of roots.

10. When the first shoot has reached this rooting stage a half-inch layer of finely sifted rotted peat, 2 parts, and clean sand, 1 part, should be placed on the surface of the cutting bed and moistened well with water.

11. The new growth, which if it had originated above the sand would be a true stem, like an ordinary shoot, was transformed in working its way through the sand and became a scaly erect rootstock, which on reaching the surface of the sand continued its development into a leafy shoot. During the spring and early summer roots form in abundance on the lower or rootstock portion of these shoots.

12. After a shoot is well rooted it makes secondary twig growth, usually from a bud in the axil of the uppermost leaf. If the rooting of the shoot has

not already been ascertained by direct examination, the making of such secondary growth is good evidence that rooting has actually taken place.

13. When a shoot is well rooted, with roots 1 to 2 inches in length, it is ready to be potted. If the shoot has not already disconnected itself from the dead cutting, it should be carefully severed with a sharp knife. In the process of tubering, the behavior of the cuttings is essentially identical with that of real tubers, like those of the potato. The original cutting dies, but the sprouts that arose from it root at the base and form independent plants.

14. The rooted shoots should be potted in clean 2-inch earthenware pots in the standard blueberry soil mixture already described.

15. The pots should be bedded in moist sand up to the rim in a glass-covered, ventilated box, well lighted, but protected from direct sunlight.

16. In order to secure rapid growth, the rooted plants should be gradually accustomed to half sunlight and a well-ventilated atmosphere, this adjustment extending over a period of about three to four weeks.

17. If preferred, the shoots may remain in the original cutting bed until the following spring before potting, the cutting bed being exposed during the winter to freezing temperatures.

TREATMENT OF YOUNG PLANTS.

When blueberry plants, either large or small, are grown in porous pots the surface of the pot should never be allowed to become dry, for the rootlets which grow through the soil to the wall of the pot for air are exceedingly fine and easily killed by drying, to the great injury of the plant. This danger may be eliminated by bedding the pots to the rim in a well-drained bed of sand or by setting the pot in another pot of 2 to 4 inches greater diameter, with a packing of moist sphagnum between and broken crocks at the bottom.

A burning of the young leaves and growing tips of twigs is often produced by the hot sun from the middle of June to the middle of September. Plants in pots or nursery beds are easily protected from such injury and forced to their maximum growth by a half-shade covering of slats, the slats and the spaces between being of the same width. On cloudy days the shade should be removed. It should not be used in fall or spring.

During the winter the rooted cuttings or 1-year-old plants should be kept outdoors, exposed to freezing temperatures, their soil mulched with leaves, preferably oak leaves. When kept in a warm greenhouse during the winter they make no growth before spring. Even then their growth is abnormal, often feeble, or sometimes deferred for a whole year.

FIELD PLANTING.

Plants from cuttings or rooted shoots are ready for permanent field planting when they are 2 or 3 years old and about 1½ to 2 feet high. They are best set out in early spring, before the buds have begun to push.

It is a curious fact that these plants send out no new roots in spring until they are in full leaf, their flowering is nearly or quite finished, and their principal twig growth has ceased. It is important, therefore, in taking up either a wild or a cultivated plant from the open ground that as much as possible of the old root mat be lifted with the plant, for upon this they depend for moisture until their new rootlets are formed.

In the case of mature wild bushes with very large root systems, when it is practicable to secure but a fraction of the root mat, say, a disk only 3 or 4 feet in diameter, it is the best procedure to cut all the stems to the ground at the time of transplanting. The bush will then produce a new and symmetrical top of a size suited to the capacity of the roots. The wood that is removed may be used for cuttings if the plant is sufficiently valuable.

In the permanent field plantation the bushes should be set 8 feet apart each way. When they reach mature size they will nearly or quite cover the intervening spaces.

To secure full vigor of growth the ground between the bushes must be kept free from all other vegetation. On rocky uplands a continuous mulch of oak leaves, when it is practicable to secure them, will help toward this end as well as keep the soil in the necessary acid condition. It is more economical, however, to choose such a location for the plantation as will permit the use of horse-drawn machinery and will make mulching unnecessary.

The most favorable location for blueberry culture is a boggy area with a peat covering and sand subsoil, the peat preferably of such a thickness that a deep plowing will turn up some of the underlying sand.

The land should be so ditched that the water level can be kept at least a foot below the surface of the ground during the growing season or can be raised for subirrigation during a drought.

The ground should be plowed to the depth of about 8 inches and repeatedly harrowed or otherwise tilled during the season preceding the planting, in order to kill the vegetation. The best time for plowing is late spring, after the principal vegetation has used up its stored starch in completing its early growth and before the leaves have matured and the roots have begun the new storage of starch with which they can send up new sprouts. After the plants are old enough to have formed a root mat, the tillage should be very shallow, not more than 2 or 3 inches, so that the roots will not be injured. This is probably best accomplished by the use of a light spring-tooth harrow with the teeth set closer together than usual.

Fertilizer experiments have shown that lime is positively injurious and that manure, while producing a temporary stimulation of vege-

tative growth, is likely to cause serious injury later. For those desiring to experiment with fertilizers the following acid mixture is recommended, applied at the rate of 1,000 pounds per acre, or one-fifth of a pound per square yard:

	Pounds.
Acid phosphate (high grade, about 16 per cent available phosphoric acid)	600
Sulphate of potash (50 per cent potash)	200
Sulphate of ammonia (20 per cent nitrogen)	200

(Muriate of potash may be substituted for sulphate of potash.)

This and similar acid mixtures have been used with success on blueberry plants, in both pot and field experiments, with no evidence thus far of cumulative injurious effects. However, as no fertilizer is required to make the swamp blueberry fruit abundantly and continuously in suitable peat and sand soils properly handled, the use of fertilizers in commercial plantations is not at present advocated.

The swamp blueberry does not require a yearly pruning. When one of the stems of a bush becomes unproductive from injury or old age it should, of course, be cut out. If a large part of a bush needs removal it is better to cut all the stems to the ground and let the plant send up new shoots all of the same age to form a wholly new and symmetrical top.

YIELD AND PROFITS.

By proper manipulation in the greenhouse, seedling blueberry plants can often be made to ripen a few berries in less than a year, but they do not come into commercial bearing in field plantations until they are about 5 years old, when the plants are 3 to 4 feet high. They then increase slowly to full size and full bearing. Wild bushes of the swamp blueberry live to great age, often 50 to 100 years, still bearing heavily. Individual stems may remain productive for 10 to 25 years. When dead they are replaced by new and vigorous shoots from the root.

The field plantings resulting from the recent experiments in blueberry culture are too young to show the mature yield. Fortunately, however, there has been found, near Elkhart, Ind., a small blueberry planting of mature age, believed to be the only commercial plantation in existence. The returns from this plantation set forward our knowledge of yields by at least a decade. The plantation is a little less than 2½ acres in extent. It was started in 1889 in a natural blueberry bog, which was first drained and then set with unselected wild blueberry bushes. The plantation was profitable from the first, but exact records of yield and receipts are available only for the years

1910 to 1912, when the plantation was 21 to 23 years old. The data are as follows:

Yield and receipts from plantation of blueberries near Elkhart, Ind., 1910 to 1912.

Year.	Yield per acre.	Price (approximate average per quart).	Receipts per acre.	Profits per acre.
	Quarts.	*Cents.*		
1910 (a year of "almost total failure" because of late spring freezes)	419	17½	$71.87	$10
1911	2,266	12⅞	292.44	139
1912	2,379	12⅞	305.75	147

The annual expenses for weeding, cultivation, and irrigation were about $20 per acre. The cost of picking was 5 cents a quart. The general cost of maintenance of the equipment was about $2 per acre per year, the crates and boxes being used repeatedly. The computation includes an estimated annual charge of $12 per acre for interest, $2 for taxes, and $4 for depreciation or sinking fund.

It must be borne in mind that these figures are based on the yields from wild bushes transplanted without selection as to individual productiveness or the size of the berries. With bushes propagated from selected stocks the yield should be greater and the berries much larger, this greater size probably effecting a reduction in the cost of picking and certainly an increase in the selling price.

Only a beginning has been made in the improvement of the blueberry. In a series of experiments involving the selection of superior wild strains, the growing of hybrids, and the forcing of choice varieties to quick fruiting by budding them on strong seedling stocks, berries eleven-sixteenths of an inch in diameter have already been produced, and it is expected that from the better wild stocks now available berries of still larger size will be developed.

[Cir. 122—B.]

THE WORK OF THE TRUCKEE-CARSON EXPERIMENT FARM IN 1912.[1]

By F. B. Headley, *Farm Superintendent, Office of Western Irrigation Agriculture.*

INTRODUCTION.

The Truckee-Carson Experiment Farm[2] was established by the Bureau of Plant Industry of the Department of Agriculture in 1906 on 160 acres of land 1 mile south of Fallon, Nev. The land was withdrawn from entry by the Reclamation Service for use as an experiment farm.

The Truckee-Carson Project is situated in one of the driest regions in the United States, the average annual rainfall being less than 5 inches. The native vegetation of the project is extremely sparse, so that the virgin soil is lacking in vegetable matter. Furthermore, the high evaporation has resulted in the accumulation of alkali salts in the surface soil on many parts of the project.

Since irrigation was commenced several years ago, surplus water has accumulated in many of the low-lying lands and a water table has thus been established. In certain parts of the project this water table is within 2 to 4 feet of the surface and its presence has a detri-

[1] Issued Apr. 19, 1913.

[2] The Truckee-Carson Experiment Farm is maintained by the Office of Western Irrigation Agriculture of the Bureau of Plant Industry. For a report on the work of the farm previous to 1909, see Scofield, C. S., and Rogers, S. J., "The Truckee-Carson Experiment Farm," U. S. Department of Agriculture, Bureau of Plant Industry, Bulletin 157, 1909. More recent publications relating to the investigational work are as follows:

U. S. Department of Agriculture, Bureau of Plant Industry:

Bulletin 211, 1911. Bacteriological studies of the soils of the Truckee-Carson Irrigation Project, by K. F. Kellerman and E. R. Allen.

Circular 91, 1912. The nematode gallworm on potatoes and other crop plants in Nevada, by C. S. Scofield.

Circular 110, p. 21–25, 1913. Agriculture on the Truckee-Carson Project: Vegetables for the home garden, by F. B. Headley and Vincent Fulkerson.

Circular 113, p. 15–22, 1913. Commercial truck crops on the Truckee-Carson Project, by F. B. Headley and Vincent Fulkerson.

Circular 114, p. 25–30, 1913. Climatic conditions on the Truckee-Carson Project, by F. B. Headley.

Circular 118, p. 17–28, 1913. Fruit growing on the Truckee-Carson Project, by F. B. Headley and Vincent Fulkerson.

The arrangement of the fields and the location of the crop experiments in 1912 are shown in figure 1.

mental effect on the soil and on crops. The three conditions above enumerated, namely, the general lack of vegetable matter in the soil, the presence of harmful quantities of alkali salts, and the existence of a high water table, determine the nature of most of the problems of crop production on the project. The investigations conducted at the experiment farm have been concerned largely with these three conditions. (Fig. 1.)

One of the first requisites of successful crop production on the project is to get the soil well supplied with vegetable matter, and the

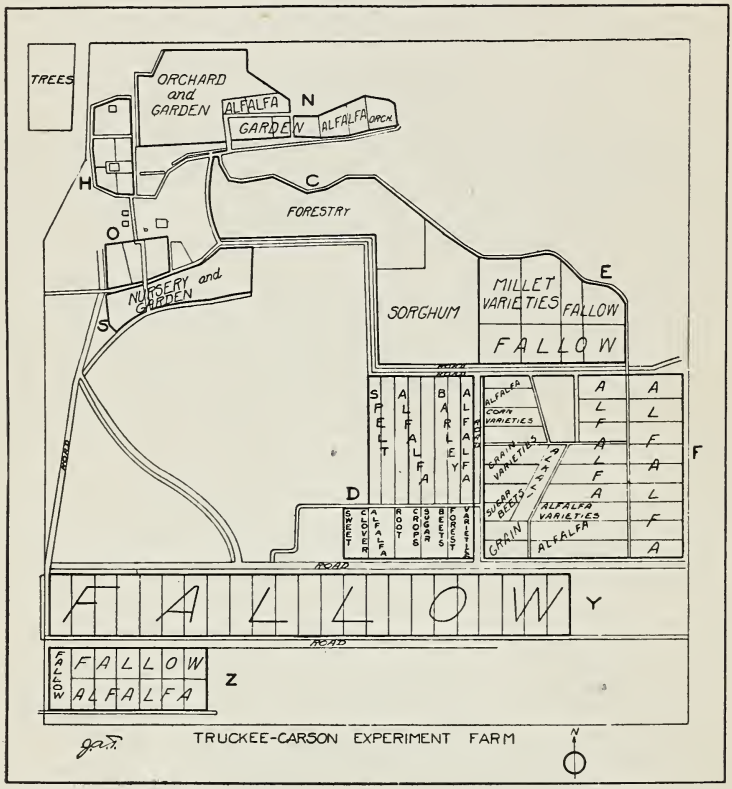

FIG. 1.—Diagram of the Truckee-Carson Experiment Farm, showing the arrangement of the fields and the location of the crop experiments in 1912.

most practical method of accomplishing this is to get a crop of alfalfa established on the land. This has been one of the principal aims of the work at the experiment farm. Numerous experiments have been conducted with a view to reducing the salt content of the soil, and in 1912 a pumping plant was installed for the purpose of lowering the level of the ground water.

The question of marketing crops is also an important one to the farmers on the project. The local market demands are so limited

that it will be necessary for the farmers to produce crops which can be profitably shipped to distant points. Commercial truck crops, such as potatoes, onions, and melons, are very promising in this connection, and much of the work of the experiment farm has been devoted to the testing of varieties and cultural methods for these crops.

Some work of an educational nature is done among the local farmers. Instruction and demonstrations are given in connection with the proper methods of tree planting, pruning, and spraying, and an active part is taken in the local agricultural fairs. Some attention has been given to finding what shade and ornamental trees and other plants could best be used in beautifying home grounds. (Fig. 2.)

CLIMATIC RECORDS.

Daily records are kept of the maximum and minimum temperatures, humidity, precipitation, evaporation, and wind velocity. This work is carried on in cooperation with the Biophysical Laboratory of the

FIG. 2.—A hedge of oleaster on the Truckee-Carson Experiment Farm. For ornamental purposes and as a windbreak oleaster is one of the most desirable plants tested at the farm.

Bureau of Plant Industry. A meteorograph has been installed on the experiment farm by the University of Nevada. This instrument records automatically on a single sheet of paper the relative humidity, temperature, barometric pressure, wind velocity, and wind direction.

Table I gives a summary of the climatological observations made since 1906.

TABLE I.—*Summary of climatological observations at the Truckee-Carson Experiment Farm, 1906 to 1912, inclusive.*

PRECIPITATION (INCHES).

Year, etc.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Average for 7 years, 1906 to 1912...	0.76	0.30	0.53	0.53	0.36	0.35	0.06	0.09	0.34	0.41	0.21	0.60	4.54
For the year 1912...	.13	.06	.37	.87	.43	.22	.13	.18	.43	1.10	.08	(1)	4.00

[1] Trace.

TABLE I.—*Summary of climatological observations at the Truckee-Carson Experiment Farm, 1906 to 1912, inclusive*—Continued.

EVAPORATION (INCHES).

Year, etc.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Average for 5 years, 1908 to 1912.....	1.24	1.96	3.52	5.93	7.97	10.22	10.64	9.80	6.06	3.71	2.13	0.80	64.01
For the year 1912...	1.24	2.13	4.15	5.66	7.40	10.39	9.64	9.03	6.07	3.43	1.97	.78	61.89

DAILY WIND VELOCITY (MILES PER HOUR).

Monthly average: 4 years, 1909 to 1912.....	3.33	3.74	4.87	5.54	4.89	4.88	3.46	3.66	3.67	3.37	3.46	3.04	.....
For the year 1912.....	3.20	3.44	5.70	6.02	4.00	5.25	3.70	3.62	3.57	3.61	3.40	3.22	.....

SKY.

Conditions in 1912:													
Days clear.....	13	14	13	16	22	22	23	27	22	18	18	18	226
Days partly cloudy.....	6	7	7	5	5	4	3	2	3	5	6	9	62
Days cloudy....	12	8	11	9	4	4	5	2	5	8	6	4	78

TEMPERATURE (° F.).

Absolute maximum: 7 years, 1906 to 1912.....	70	72	79	89	102	101	101	103	95	88	81	72	.....
For the year 1912.....	70	64	70	76	86	96	100	97	90	78	72	58	.....
Absolute minimum: 7 years, 1906 to 1912.....	−15	−12	9	13	25	33	38	36	26	15	− 3	−3	.....
For the year 1912.....	− 7	8	9	22	29	36	38	39	29	19	13	1	.....
Mean: 7 years, 1906 to 1912.....	31.34	37.46	43.53	50.95	56.06	65.16	73.70	71.14	60.54	50.20	40.31	31.71	.....
For the year 1912.....	34.2	37.8	40.9	47.3	56.4	65.5	69.9	68.2	58.2	46.9	40.6	30.7	.....

KILLING FROSTS.

Year.	Last in spring.	First in fall.	Length of frost-free period.
			Days.
1906	May 31	Oct. 4	126
1907	May 14	Sept. 19	128
1908	May 30	Sept. 25	118
1909	May 24	Sept. 22	121
1910	May 16	Sept. 13	120
1911	May 27	Oct. 18	144
1912	May 22	Sept. 25	126
Average	May 23	Sept. 26	126

CONDITIONS ON THE PROJECT.

During the season of 1912 weather conditions on the project were generally favorable to the growth of crops. Some damage was done to tender vegetables and to orchards by a heavy windstorm on April

29, and a high wind on June 20 resulted in some injury to the sugar-beet crop. The disease known as curly-top, which destroyed a large area of sugar beets in 1911, was absent in 1912, and the yield was good, although the acreage was much smaller than in 1911. The damage to the potato crop by the nematode gallworm was much less extensive than it was the previous year.

The total irrigable area of the 497 farms on the project in 1912 was 54,937 acres, of which an area of 36,620 acres was actually irrigated. The acreage, yields, and farm values of the crops grown in 1912 are stated in Table II. The figures were obtained from the United States Reclamation Service.

TABLE II.—*Acreage, yields, and farm values of crops grown on the Truckee-Carson Project in 1912.*

Crop.	Area.	Unit of yield.	Yield.			Farm value.			
			Total.	Per acre.		Per unit of yield.	Total.	Per acre.	
				Average.	Maximum.			Average.	Maximum.
	Acres.								
Alfalfa hay	12,912	Ton	33,595	2.60	6.50	$7.00	$235,165	$18.21	$45.50
Alfalfa and grain hay	3,319	do	820	.25	.....	7.00	5,740	1.73	.....
Grain hay	284	do	319	1.12	4.05	7.00	2,233	7.85	28.35
Wheat	2,484	Bushel	40,600	16.34	63.33	.90	36,540	14.71	57.00
Barley	2,259	do	74,792	33.11	70.00	.85	63,573	28.14	58.50
Oats	399	do	16,875	42.29	125.00	.51	8,606	21.57	63.75
Sugar beets	254	Ton	2,382	9.38	25.70	5.75	13,697	53.93	147.77
Potatoes	483	Bushel	65,633	135.89	333.33	.375	24,612	50.96	125.00
Native pasture	15,004	.....	.....	.....	.....	.....	60,016	4.00	.....
Fruit	189	.....	.....	.....	.....	.....	2,000	10.58	.....
Garden	150	.....	.....	.....	.....	.....	15,000	100.00	.....
Miscellaneous	135	.....	.....	.....	.....	.....	2,700	20.00	.....
Less duplications	1,252	.....	.....	.....	.....	.....	.....	.....	.....
Total	36,620	.....	.....	.....	.....	.....	469,882	.....	.....
Average value per acre	.....	.....	.....	.....	.....	.....	.....	12.83	.....

FIELD-CROP EXPERIMENTS.

On account of the great lack of uniformity in the soil of the experiment farm and the presence of harmful quantities of alkali salts, the field-crop experiments have not been extensive. Until the experiments which are being conducted with a view to removing the alkali salts from the soil are successfully applied to the entrie farm, the crop experiments will be much limited, both in number and in land area used. There is given below a brief account of the more important field-crop tests conducted in 1912.

SUGAR BEETS.

A fertilizer test with sugar beets was conducted on a clay soil which had not previously grown a cultivated crop. The soil was not uni-

form in texture and it contained some black alkali. It was highly impervious to water, and during the hot months a hard surface crust would form after each irrigation.

The beets were drilled in rows 80 feet long and 18 inches apart and irrigated by furrows in every other row. There were alternately two fertilized rows and four unfertilized or check rows. Of the four check rows only the two middle rows were weighed at harvest time, as it was thought that the rows next to those to which fertilizer had been applied might have been affected by the spread of the fertilizer.

The beets were small and the yields poor, but the results obtained with a few of the combinations of fertilizers were clearly beneficial. Those combinations which resulted in a decided increase in yield were as follows:

Sodium nitrate and potassium sulphate applied at the rate of 290 pounds per acre.

Acid phosphate and potassium sulphate applied at the rate of 290 pounds per acre.

Sodium nitrate, potassium sulphate, and acid phosphate applied at the rate of 540 pounds per acre.

Sodium nitrate, potassium sulphate, acid phosphate, and gypsum applied at the rate of 750 pounds per acre.

EFFECT OF ALFALFA ON SUGAR BEETS.

Several fields on private ranches were surveyed for the purpose of determining the yields of sugar beets on various types of land. The results are shown in Table III.

TABLE III.—*Effect of various types of land on the yields of sugar beets.*

Previous crop.	Kind of soil.	Area.	Yield per acre.	Sugar content.
		Acres.	*Tons.*	*Per cent.*
Alfalfa	Loam	21.3	19.4	18.1
		1.16	25.3	18.0
		4.3	18.9	18.8
None	Adobe	2.26	3.6	21.8
	Sandy loam	2.46	9.9	19.8

These results indicate that a previous growth of alfalfa has a decidedly beneficial effect on the yield of sugar beets.

SWEET CLOVER.

Sweet clover has always been considered as undesirable in many sections of the country, but farmers on the Truckee-Carson Project have come to think well of it. It has been grown for a number of years at the experiment farm, usually on soils where alfalfa would

not grow well. It can be grown successfully on soil containing more black alkali than is tolerated by alfalfa. It has been found that if the crop is cut before blossoming, live stock soon learn to eat it. It has been observed that some horses and cattle eat it as readily as they do alfalfa, while it is apparently disliked at first by others.

It is not recommended that this crop be grown on land that will grow alfalfa successfully, but it may frequently be used on land which for some reason will not produce other crops. The sweet clover may be used as a forage crop to feed live stock or it may be plowed under when several feet high to help bring the soil into better condition.

FIG. 3.—Row tests of alfalfa varieties at the Truckee-Carson Experiment Farm in 1912. Twelve varieties were tested in this manner.

When sweet clover comes up in an alfalfa field it can be killed out the second year, provided the crop is cut during the two years early enough to prevent the clover from producing seed.

ALFALFA.

In April, 1911, 12 varieties of alfalfa were seeded in rows 30 inches apart. (Fig. 3.) The rows were from 320 to 336 feet in length. The entire series was planted in duplicate. The seed of these varieties was furnished by the Office of Forage-Crop Investigations. The results obtained in 1912 are presented in Table IV.

TABLE IV.—*Yields of alfalfa varieties in row tests at the Truckee-Carson Experiment Farm in 1912.*

Variety.	First crop.	Second crop.	Third crop.	Total.	Length of row.	Yield per 100 feet of row.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Feet.*	*Pounds.*
Caucasus	230	135	38	403	320	126
Medicago ruthenica	0	0	0	0	322	0
Arabian	80	95	82	257	324	79
Peruvian	140	140	91	371	325½	114
Grimm	215	155	57	427	326½	131
Sand lucern	115	115	43	273	327	83.5
Turkestan	185	120	49	354	328	108
Montana	185	120	69	374	330½	113
Canadian	195	135	59	389	333	117
Western Grown	175	145	70	390	334½	117
Provence	150	120	53	323	335	96
Elche	85	120	62	267	336	79

The Grimm, Caucasus, Western Grown, and Canadian varieties gave the largest yields. The Grimm alfalfa started early in the spring and was ready to cut before any of the other varieties.

MILLET.

Four varieties of millet were grown, namely, the Japanese, Colorado Golden, Hog, and New Siberian. Of these the Japanese yielded the greatest amount of hay, but the Colorado Golden was the earliest and set a large quantity of heavy, plump seeds. The Colorado Golden promises to be valuable on account of its short season and high seed production. Further tests will be made with it for the purpose of ascertaining its seed yield per acre.

FIELD CORN.

A number of varieties of field corn have been tried for several years without obtaining at any time sufficiently large yields to indicate that corn will be a commercially profitable crop in this section, except possibly in the most fertile soils of the old river bottoms. During some years the early dent varieties have a sufficiently long period to mature, but it is probable that for the average season some of the flint varieties will give the highest yields. The Australian White Flint was the earliest and best yielding variety tried in 1912.

HORTICULTURAL WORK.

There are two small orchards on the experiment farm. One of these came into bearing for the first time in 1912. Observations have been made on the bearing orchards on some of the older ranches of the project during the past three years. Identifications have been made of many of the varieties and notes as to their relative productivity have been taken. A few of these old orchards have been

plotted and, so far as possible, the variety name of each tree inserted. The results of the horticultural work have been published separately.[1]

TESTS OF VEGETABLES.

For several years variety tests have been made with a number of vegetables. Good results have been obtained with asparagus, beans, table beets, carrots, sweet corn, cucumbers, kohl-rabi, melons, onions, peas, potatoes, pumpkins, rutabagas, squashes, tomatoes, and turnips. The results of this work up to and including the season of 1912 have recently been published in detail, together with directions applicable to each crop.[2]

COOPERATIVE WORK WITH FARMERS.

Since the soil of the experiment farm is not yet in suitable condition for experimental crop work, it has seemed advisable to conduct some of the more urgent crop tests on adjacent older farms, where the soil is better adapted to this work. The greater part of the cooperative work in 1912 was done with potatoes, onions, and strawberries.

POTATOES.

Arrangements were made in 1912 with J. W. Ferguson, Fallon district; W. Vanvoorhis, Stillwater district; Dr. Richards, Island district; and J. W. Rawles, Fernley district, for conducting experiments with fertilizers on potatoes. Seed potatoes from a northern State were used, to avoid danger of introducing eelworms. A variety known as Colorado Pearl, or White Pearl, was purchased from a seed firm in Utah. It was found, after planting, that the germination of this seed was poor, and consequently a poor stand resulted on all the farms, so that at harvest time the fertilizer effect could not be determined.

ONIONS.

A piece of land was selected on the farm of A. R. Merritt as suitable for the onion test. The land had previously been in clover pasture for three years and was manured with well-rotted stable manure during the winter prior to planting.

One hundred and ten rows of onions were planted, with varying quantities and kinds of fertilizers. At the end of the season each row was harvested and weighed separately. It was found that the

[1] U. S. Department of Agriculture, Bureau of Plant Industry, Circular 118, p. 17–28, 1913. Fruit growing on the Truckee-Carson Project, by F. B. Headley and Vincent Fulkerson.

[2] Bureau of Plant Industry, Circular 110, p. 21–25, 1913. Agriculture on the Truckee-Carson Project: Vegetables for the home garden; and Circular 113, p. 15–22, 1913. Commercial truck crops on the Truckee-Carson Project.

average difference between the yields of unfertilized and fertilized rows was insignificant. The indications are that on rich soil, such as was used in this experiment, commercial fertilizers are of little or no value.

STRAWBERRIES.

In April, 1912, 25 plants each of 20 varieties of strawberries were planted on the farms of W. J. Ferguson, Fallon district; W. Vanvoorhis, Stillwater district; and W. W. Cogswell, Fernley district. As strawberries do not produce a crop until the second year, a report can not be made at the present time on the relative desirability of these varieties.

ALKALI AND GROUND-WATER STUDIES.

Since the establishment of the experiment farm studies have been made to determine the causes of the poor growth made by plants on much of the land, not only on the experiment farm but on numerous other farms on the project. Some very definite results have been obtained and are being prepared for publication.

It has been found that sodium carbonate ("black alkali"), sodium bicarbonate, and sodium chlorid are the alkali salts chiefly affecting the growth of plants. These salts are found in widely varying quantities on different parts of the project, and the proportions in which they are associated are very irregular. Table V states, in percentages, the quantities of sodium carbonate, sodium bicarbonate, sodium chlorid, and other salts found in field S on March 16, 1912, where alfalfa was doing well and also where its growth was not good. This table gives a general idea of the nature and quantities of the alkali salts found on much of the land on the project, but, as before stated, there are wide variations in this feature.

TABLE V.—*Percentage of alkali salts determined on March 16, 1912, on an alfalfa plat in field S, Truckee-Carson Experiment Farm.*

Depth (inches).	Sodium carbonate.		Sodium bicarbonate.		Sodium chlorid.		Other salts.		Total salts.	
	Good growth.	Poor growth.	Good growth.	Poor growth.	Good growth.	Poor growth.	Good growth.	Poor growth.	Good growth.	Poor growth.
0–8.....	0	.....	0.082	0.027	0	0.003	0.179	0.180	0.261	0.210
8–16.....	0	0.029	.073	.141	0	.....	.082	.305	.155	.475
16–24.....	0	.087	.190	.156	0	.073	.225	.166	.415	.482
24–36.....	0	.095	.098	.370	0	.028	.067	.159	.165	.652

Before successful crop production can be accomplished on lands containing harmful quantities of these salts, methods for reducing the salt content of the soil must be perfected and put into practice.

Much attention has been given to this problem at the experiment farm. Some progress has been made in washing the salts from the surface soil by use of irrigation water after treating the soil with gypsum, but it has been found that before reclamation can be made complete it will be necessary to lower the level of the ground water.

Weekly determinations of the elevation of the water table were made in 19 test wells on the farm during the year 1912. The average depth to ground water was 4.43 feet on April 1, 3.79 feet on June 3, and 4.86 feet on December 27. Salt determinations made on the water in these wells on June 9 showed that the average content of sodium chlorid was 0.868 per cent and that of sodium bicarbonate 0.174 per cent. The water in only seven of the wells contained sodium carbonate ("black alkali") on the same date. The average sodium carbonate content of the water in these seven wells was 0.071 per cent.

It is obvious that successful production of the common field crops will be impossible on this land until the water table is lowered. To attain this end, an electric pumping plant was installed near the southwest corner of the experiment farm in the autumn of 1912 and a tile drainage system was put in at an average depth of $4\frac{1}{2}$ feet. The pumping plant will lift the water collected by this drainage system and discharge it into the surface drain used by the Reclamation Service. It is expected that the use of this system will prevent the rise of the water table each year during the irrigation season and make it possible to continue the work of washing the injurious salts from the surface soil.

[Cir. 122—C.]

FETERITA, A NEW VARIETY OF SORGHUM.[1]

By H. N. Vinall, *Assistant Agrostologist, Office of Forage-Crop Investigations,* and Carleton R. Ball, *Agronomist, Office of Cereal Investigations.*

HISTORY.

The name "feterita" is used for a variety of sorghum first obtained in 1901 by the Office of Foreign Seed and Plant Introduction as "Feterite" from B. Nathan & Co., Alexandria, Egypt. Only a small quantity of seed was secured, and this was distributed under Seed and Plant Introduction No. 6691 to three persons in Arizona and Kansas, but no records of the results obtained are available. It is certain, however, that the variety did not become established at that time. The second importation, assigned S. P. I. No. 19517, was received November, 1906, from Mr. V. F. Naggiar, of Alexandria, Egypt, who obtained the seed from Sudan. In 1908 an additional supply, S. P. I. No. 22328, was secured through Mr. R. Hewison from Khartum, Sudan, in which region it is commonly grown under the name "feterita." As it is a member of the durra group of sorghums, the name "Sudan durra" has also been applied to it. The value of feterita as compared with the other sorghums of the Sudan is indicated by the following quotation from Schweinfurth:[2]

> Both varieties of the common sorghum, which here abound in all their minor differences of colour, shape, and size of grains, yield well-nigh a dozen different descriptions for the market at Khartoom. The standard of value is fixed by the Fatareetah, a pure white thin-skinned grain, which also is grown by the negroes in the Seriba.

FitzGerald[3] also speaks of feterita as the most valuable of the varieties grown by the natives of Sudan. It has been tested for six years at the Chillicothe Forage Field Station and for five years at the Amarillo Cereal Field Station, both in northwestern Texas. It

[1] Issued Apr. 19, 1913.

Much of the material for this publication was collected at Chillicothe, Tex., by Mr. G. E. Thompson, formerly connected with the Office of Forage-Crop Investigations. The publication as now presented was completed by the writers after Mr. Thompson's resignation from the Department of Agriculture.

[2] Schweinfurth, Georg. The Heart of Africa. Tr. by Ellen E. Frewer. New York, 1874, v. 1, p. 245–246.

[3] FitzGerald, W. W. A. Report on the Improvement and Possible Development of the Cultivable Products of the Sudan, Cairo, 1903, p. 25.

has also been tested during shorter periods at other field stations in the southern Plains area. For the last three years there has been an increasing acreage grown by farmers in that section.

The account of the crop given here is based on the results of these station tests and upon the experiences of farmers.

DESCRIPTION.

Feterita is an early-maturing, drought-escaping sorghum of considerable promise both for grain and forage. It has rather slender stems, varying in height from 4 to 7 feet with locality and season. They are somewhat juicy and very slightly sweet before ripening. Suckers are produced freely when moisture is sufficient and are usually taller and later than the main stalk. The plant also branches freely under favorable conditions, and the branch heads are late in ripening. These habits result in considerable unevenness in maturity.

Feterita resembles milo in habit, except that the heads are uniformly erect and the seeds are larger, softer, and chalk white or slightly bluish white in color. It differs from the ordinary white durra (Jerusalem corn) in having naturally erect heads, black glumes, and plumper seeds. The seed shatters more than milo but less than common white durra if the crop is allowed to stand in the field until overripe.

It is as early or a little earlier than Dwarf milo and two to three weeks earlier than standard Blackhull kafir. In drought resistance it compares favorably with any sorghum yet introduced. In general, the yields have been equal to those of the other grain sorghums and in some cases better, for reasons which are fully discussed later.

PROBABLE VALUE.

From the foregoing description it will be seen that feterita is more like milo than kafir. It resembles milo in earliness, in the size and height of stalk, in the relatively dry pith, the few leaves, the shape of the head, and the large seeds. It differs from milo most sharply in having the heads all naturally erect and in its larger white seeds.

It has become quite popular in parts of northern Texas, because in 1911, a year of severe drought, it produced good grain yields when both milo and kafir gave low yields. In that year much of it was planted on land where the corn crop had been destroyed by drought. In the vicinity of Chillicothe, Tex., many farmers are planting increased areas to feterita in preference to either milo or kafir.

There is no satisfactory evidence that feterita is inherently more drought resistant than other grain sorghums. The Chillicothe re-

sults above referred to may have been due to thinner stands, concerning which no exact data were taken. It often happens that thin stands of feterita are caused by failure of the seed to germinate, especially if planted while the ground is cold. Furthermore, the larger seed of feterita would give thinner stands if planted at the same rate as milo or kafir. At Amarillo, where feterita was grown under identical conditions as to stand, it showed no greater drought resistance than milo or kafir.

Much interest has been aroused also in feterita by the extravagant advertising it has recently received from persons either not competent to determine its merits in comparison with other grain sorghums or from those who had seed to sell at fancy prices.

Experiments so far indicate that its earliness, its rather low water requirements, its satisfactory yields, and the ease with which it may be harvested give it a real place among the sorghums either for grain or combined grain and forage purposes. No farmer should discard milo, Dwarf milo, or Dwarf kafir for feterita, however, until he has determined with certainty that on his farm it will outyield these staple crops when grown under identical conditions. The data at hand are limited, but they do not justify the claim that feterita will outyield Dwarf milo.

PLANTING.

Like other grain sorghums, feterita should be planted in rows 40 to 44 inches apart, or about the same distance as for maize, or Indian corn. The time of planting will vary greatly, but, in general, it should be two to three weeks later than for Indian corn in the same season and locality. In sections affected by the sorghum midge very early plantings are recommended. It is not well to plant too early, while the ground is still cold, since feterita, like other sorghums, is naturally a warm-weather plant. Owing to the soft seed there is liable to be considerable loss through decay before germination unless the soil is warm enough to sprout the seed at once. Difficulty in obtaining a stand has been experienced in some localities, the poor stand probably being due to planting in cold ground.

On the Chillicothe field station, in 1912, plantings of March 19 rotted in the ground, while plantings from the same seed on April 4 and 26 and plantings from a separate lot of seed on May 2 germinated perfectly. At Amarillo a planting on May 11 resulted in a poorer stand and lower yield than plantings on May 22 and 27, about the normal time.

Feterita may be planted either in a furrow with the lister or surface planted with the ordinary corn planter, according to the local custom with related crops. When planted in cultivated rows in this

manner 3 to 5 pounds of seed to the acre will be required. The seed should always be sown in a good, firm seed bed and covered with 1 to 2½ inches of soil.

In only exceptional cases will it pay to sow feterita broadcast for hay. However, if put in with a wheat drill for this purpose 1½ to 2 bushels per acre will give the best results.

CULTIVATION.

Feterita should be cultivated in much the same manner as corn. If the ground is in good shape the harrow will be found the most economical tool for the first two or three cultivations. A thorough and rather deep cultivation should be given when the crop is about 12 inches high. Two later cultivations will be necessary to conserve moisture properly, and in case the ground is foul with weeds still more may be required. In these later cultivations care must be taken that the surface feeding roots are not broken.

In order to save all possible moisture it will be found best to cultivate or harrow after each rain as soon as the ground is dry enough. When the crop has attained such a size that a 2-horse cultivator can not be used, a 1-row, 5-tooth cultivator will be found a very efficient tool. This is also used in many cases to stir the surface quickly after a shower when it would not be practicable to cultivate with a 2-horse plow. When the cultivation is finished the ground should be very nearly level. It does not pay to "ridge the rows," as is often done with corn or milo.

HARVESTING.

For combined use as forage and grain the crop should be cut in the late dough stage. When planted in rows the crop can best be handled with a corn harvester and put in shocks of 20 to 40 bundles each. In sections where there is little danger of rain the shocks may be larger, if desired. If these shocks are allowed to stand for some time before being headed, it will allow more complete maturity of the heads borne on the suckers. When the crop is intended solely for grain it should be allowed to stand until the earliest heads are fully mature, but if left until all the heads on suckers are completely ripe considerable seed may be lost through shattering.

Some follow the practice of cutting the heads from the bundles at the time of shocking by holding the bundles across a chopping block attached to the side of the wagon box. The heads fall inside the wagon box and can be hauled at once to a storage shed preparatory to being thrashed, while the bundles are set up in the field to be used later. If this practice is followed, the grain should be fully mature at the time of cutting. Another method followed with the

grain sorghums where large acreages are grown is to harvest the heads by means of a grain header so remodeled as to place the cutter bar at the proper height.

At lower elevations, when the season is favorable and the seed has been planted early, the first crop can often be harvested with a binder and later a good crop of heads obtained from second growth. In an ordinary year the second growth will furnish abundant pasture even though a second grain crop is not produced.

Where the heads are cut from the standing stalks in the field it is best to pasture the remainder of the crop. Should the crop go down on account of a storm before it is harvested it can be utilized by pasturing with hogs or cattle. Owing to the fact that the head of feterita is quite heavy in proportion to the stalk, the crop sometimes lodges badly in wet weather if left in the field until overripe. This makes it desirable to harvest as soon as the crop is mature.

THRASHING.

Feterita can be thrashed with an ordinary grain separator by decreasing the speed of the cylinder and removing some of the concaves. If a foot or more of stem is left attached to the head, fewer grains will be broken in thrashing.

YIELDS.

The yields of grain obtained during the five years from 1908 to 1912, inclusive, at the Amarillo Cereal Field Station are presented in Table I. For comparison the average yields obtained each year from the various selections of milo and Dwarf milo are also given. In the first four years the yields of feterita are seen to be fairly intermediate between those of the other two crops, being higher than those of milo and lower than those of Dwarf milo. In 1912, feterita slightly exceeded Dwarf milo in grain yield. These results may be taken as fairly representative of what may be expected of feterita on the high plains in comparison with the milos. The considerably thinner stands of the feterita are indicated by the row-space figures.

TABLE I.—*The growing period, row space, and grain yields obtained from feterita at the cereal field station, Amarillo, Tex., 1908 to 1912, inclusive, compared with average similar data for milo and Dwarf milo.*

Year and variety.	Number of plats.	Growing period.	Row space.		Acre yield.	
			To 1 plant.	To 1 stalk.	By plats.	Average.
1908:		*Days.*	*Inches.*	*Inches.*	*Bushels.*	*Bushels.*
Feterita	1	102	10.0	4.4	40.2	40.2
Milo	6	105	9.3	5.1	.....	35.6
Dwarf milo	5	105	8.6	3.9	.....	4.13
1909:						
Feterita	1	99	16.1	10.3	9.3	9.3
Milo	14	.....	11.7	6.7	.....	6.1
Dwarf milo	10	.....	11.8	7.3	.....	11.0
1910:						
Feterita	1	116	37.3	9.3	14.7	14.7
Milo	20	109	24.2	8.6	.....	17.6
Dwarf milo	17	112	18.8	7.1	.....	19.0
1911:						
Feterita	1	102	14.6	5.3	31.9	.....
	1	107	11.5	3.7	35.1	.....
	1	107	10.7	3.5	35.2	.....
	1	107	13.1	3.9	34.5	.....
Average	.....	106	12.5	4.1	.....	34.2
Milo	10	111	26.2	9.8	.....	30.0
	9	111	15.0	5.9	.....	34.8
Dwarf milo	15	110	10.7	4.3	.....	37.6
1912:						
Feterita	1	122	12.2	4.3	24.5	.....
	1	132	20.9	5.3	21.7	.....
	1	113	32.6	13.5	16.2	.....
	1	116	21.8	5.3	27.3	.....
	1	116	34.8	7.5	24.6	.....
Average	.....	120	24.5	7.1	.....	22.9
Milo	17	107	7.2	3.5	.....	18.9
Dwarf milo	16	107	6.2	3.2	.....	22.6

The yields per acre at the State substation, Lubbock, Tex., for 1912 are as follows:

	Bushels.
Feterita	57.71
Blackhull kafir	43.96
White milo	42.40

The rainfall for Lubbock from January 1 to October 1, 1912, was 11.40 inches, and for the entire year 14.60 inches. Lubbock is situated south of Amarillo on the plains, and the climatic conditions are similar.

At Chillicothe, Tex., in 1912, a plat of feterita gave a yield of 4,800 pounds of dry fodder per acre, while a plat of Dwarf milo planted at the same time made 3,210 pounds per acre. The grain yield on these plats was 30.4 bushels for feterita and 28.4 bushels per acre for the Dwarf milo. These station yields in most cases are not widely different for the two crops, feterita and Dwarf milo, and more data are necessary before definite conclusions are reached regarding their comparative value.

The yields on farms about Chillicothe, Tex., look more favorable for feterita. In one case feterita planted on June 8, 1911, yielded 22 bushels to the acre. On this same farm, after corn had failed on account of dry weather, the corn land was listed and 1.5 acres of feterita planted on July 25. Every stalk produced a mature head, and this field made about 30 bushels per acre. Milo and kafir planted at the same time only partially headed. The rainfall from March 1 to December 1, 1911, was but 14.72 inches, and as the distribution was decidedly unfavorable the season was a severe test on any crop. In 1912 the same farmer planted 8 acres on April 15. A representative acre of this field, topped and thrashed by hand, made a yield of 51 bushels by actual weight.

Headed feterita will thrash out about the same percentage of grain as milo or kafir. On the Chillicothe field station one lot of heads, weighing 1,215 pounds, thrashed and cleaned 77.9 per cent, and another lot of 255 pounds thrashed and cleaned 76 per cent of grain.

FEEDING.

The forage value of feterita is at least equal to and probably superior to milo. For strictly forage purposes, however, it is excelled by both kafir and the sorgos, or sweet sorghums. The heavy proportion of grain makes it a very efficient feed for horses, cattle, or sheep when used in the bundle. It also makes a good roughage when fed in connection with concentrates for fattening. Like the other sorghums, feterita is not particularly efficient as a milk producer. For use as silage, feterita will probably be found equal to any other sorghum. The grain itself is undoubtedly comparable to milo or kafir, 10 bushels of it being equal to 9 or more bushels of shelled maize in feeding value. Whether the softer grain of feterita is an additional advantage in feeding remains to be determined. The seed coats apparently contain no tannin.

SEED SELECTION.

Home-grown seed is generally more productive than seed brought from a distance. This makes it desirable for every farmer to select and save seed for his own planting. This practice is important with feterita, because it is a new crop, somewhat variable and not fully adapted, and also because much natural crossing occurs with other sorghums. Seed selections should be made at a distance of 100 yards or more from other varieties. In all selections care should be taken to avoid hybrids. Exceedingly large heads are generally the result of hybridization or of some local variation in stand or in soil conditions and are not usually desirable. The largest head from the least

row space is what determines the yield. Selections are best made in the field as soon as the first heads mature. Only leafy, erect plants that have no side branches and little tendency to produce suckers should be chosen. The head should be entirely free from the boot, large, and well filled from butt to tip. Such plants, if seeded thickly enough, will produce as much seed as the stooling type and will be much easier to harvest on account of the more uniform maturity of the heads. The field should be rogued consistently each season to remove other types of sorghum if the grain is intended for home planting or for sale as seed.

SUMMARY.

Feterita is a sorghum from the British Egyptian Sudan, in Africa. It is a durra, related to white durra and to milo, with slender stems 4 to 7 feet high under varying conditions, erect heads, and large, rather soft, white grains.

Extravagant claims have been made for feterita by uninformed or interested persons. Experiments show it to be a good grain and forage crop, but not in any way meriting extraordinary praise. It has proved about equal to milo in yield.

All cultural operations are much the same as for milo and kafir, though certain differences are pointed out.

Feterita is newly introduced and quite varitable. Therefore seed selection and improvement should be practiced in each district where it is grown in order to obtain adapted strains.

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